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Indian Standard (Reaffirmed 2003)

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

(First Revision)

UDC 001·4 : 621·396·67

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 9 *January* 1989

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) (Part 21) was adopted by the Bureau of Indian Standards on 9 March 1988, after the draft finalized by the Basic Standards on Electronics and Telecommunication in consultation with the Radio Communications Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 A series of standards has been brought out with a view to bringing together the terms relating to radio communications covering different aspects, such as circuits sound and television broadcasting, transmitting and receiving equipment, radio telegraphy, and mobile radio.

0.2.1 This standard deals with terms relating to antennas.

0.3 This standard was originally published in 1967. This is being revised to bring it in line with the latest edition of the International Electrotechnical Commission publication.

0.4 The terminology on antennas has been covered in 6 sections:

Section 1 Basic terms for antennas and antenna assemblies,
Section 2 Terms relating to electrical or radiating characteristics of antennas,
Section 3 Terms relating to types of antennas defined by their electrical or radiating characteristics,
Section 4 Terms relating to antennas and antenna elements consisting mainly of radiating conductors,
Section 5 Terms relating to antennas and antenna elements consisting mainly of radiating surfaces and apertures, and
Section 6 Terms relating to devices associated with antennas.

0.5 This standard is based on IEC Doc : 1 (IEV 712) (Central Office) 1240 Chapter 712 of IEC: Antennas, issued by the International Electrotechnical Commission (IEC).

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

Section 1 Basic Terms for Antennas and Antenna Assemblies

(First Revision)

1. SCOPE

1.1 This standard (Part 21/Sec 1) (First Revision) covers definitions of basic terms for antennas and antenna assemblies.

2. TERMINOLOGY

2.1 Antenna, Aerial (Deprecated) — That part of a radio transmitting or receiving system which is designed to provide the required coupling between the system and the medium in which the radio wave propagates.

NOTE 1 — In practice, the terminals of the antenna or the points to be considered as the interface between the antenna and the transmitter or receiver should be specified.

NOTE 2 — If the transmitter or receiver is connected to its antenna by a feed line, the antenna may be considered to be a transducer between the guided radio waves of transmission line and the radiated waves in space.

2.2 Antenna System — An antenna together with those mechanical and electrical parts necessary for its proper functioning.

NOTE — The terms 'Antenna system' is used for one antenna as well as for a collection of antennas (*see* 2.3).

2.3 Multiple Antenna System — A collection of antennas together with those mechanical and electrical parts necessary for their proper functioning.

NOTE 1 — These mechanical and electrical parts may be, for example, switches or common feed lines.

NOTE 2 — The term 'Antenna system' is used for one antenna as well as for a collection of antennas (*see* 2.2).

2.4 Radiating Element — A basic subdivision of an antenna which is designed to support the radio frequency currents of fields that contribute directly to the radiation pattern of the antenna.

NOTE 1 — An antenna may comprise one or more radiating elements.

NOTE 2 — A radiating element may be driven or not driven.

NOTE 3 — Some parts of the antenna such as struts mav support parasitic radio frequency currents or fields which can cause the desired radiation of the antenna to be perturbed.

2.5 Array (Antenna) Antenna Array — An antenna comprised a number of identical radiating elements, congruent under translation, arranged and excited to obtain a prescribed radiation pattern.

NOTE — This term is sometimes applied to cases where the elements are not identical or congruent under translation. For those cases, qualifiers shall be added to distinguish from the usage implied in this definition. For example, if the elements are not identical, one may use the term 'array of non-identical elements'.

2.6 Linear Array (Antenna) — An array in which corresponding points of the radiating elements lie along a straight line.

2.7 Planar Array (Antenna) An array in which corresponding points of the radiating elements lie in a plane.

2.8 Conical Array — An antenna comprised a number of identical radiating elements of which each set of corresponding points lie on a conical surface.

2.9 Cylindrical Array — An antenna comprised a number of identical radiating elements of which each set of corresponding points lie on a cylindrical surface.

2.10 Spherical Array — An antenna comprised a number of identical radiating elements of which each set of corresponding points lie on a spherical surface.

2.11 Circular Array, Ring Array — An antenna comprised a number of identical radiating elements of which each set of corresponding points lie on a circle.

NOTE — Practical circular arrays may include arrangements of elements that are congruent under translation or rotation.

2.12 Flush-mounted Antenna — An antenna constructed into the surface of a mechanism or a vehicle without affecting the shape of that surface.

2.13 Conformal Antenna, Flush Mounted Antenna — An antenna which conforms to a surface whose shape is mainly determined by considerations other than electromagnetic, for example, aerodynamic or hydrodynamic considerations.

2.14 Conformal Array — An array which conforms to a surface whose shape is mainly determined by considerations other than electromagnetic, for example, aerodynamic or hydrodynamic considerations.

2.15 Antenna Ray — A basic subdivision of an array usually consisting of those elements fed by a single branch of the feedline.

2.16 Panel (of Radiating Elements) — A rigid assembly consisting of an array of radiating elements supported by a reflecting plane.

2.17 Feed (of an Array) — The arrangement of transmission lines and associated components in an array antenna, connecting the driven elements to the input port of the array.

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

Section 2 Terms Relating to Electrical or Radiating Characteristics of Antenna

(First Revision)

1. SCOPE

1.1 This standard (Part 21/Sec 2) (First Revision) covers definitions of terms relating to electrical or radiating characteristics of antenna.

2. TERMINOLOGY

2.1 Reactive Near Field (Region); Induction Field (Region); Reyleigh Region (Deprecated) — That region of space immediately surrounding an antenna, where the predominant components of the electromagnetic field are those which represent an exchange of reactive energy between the antenna and the surrounding medium.

2.2 Far Field Region — That region of the electromagnetic field of an antenna where the angular field distribution is essentially independent of the distance from a specified point in the antenna region.

Note 1 — In the far field region, the components of the electromegnetic field essentially represent a propagation of energy and their amplitudes decrease in proportion to the reciprocal of the antenna distance.

Note 2 — If the antenna has a maximum overall dimension, D which is large compared to the wavelength, the far field region is commonly taken to exist at distance greater than $2D^2$ from the antenna.

Note 3 — The far field patterns of certain antennas such as multibeam reflector antennas are sensitive to variations in phase over their apertures. For these antennas $2D^2/\lambda$ may be inadequate.

2.3 Fraunhofer Region — The region at each point of which the phases of any specified field components emanating from all elements or subareas of an antenna do not deviate more than a specified amount.

Note — If the outer bound of the Fraunhofer region approaches infinity, it is identical to the far field region, and the antenna is said to be focused at infinity.

2.4 Radiating Near Field (Region) — That region of space between the reactive near field region and the far field region, wherein the predominant components of the electromagnetic field are those which represent a propagation of energy, and wherein the angular field distribution is dependent upon the distance from the antenna.

Note — If the antenna has a maximum, overall dimension which is not large compared to the wavelength, the radiating near field region may not exist practically.

2.5 Fresnel Region — The region or regions adjacent to the Fraunhofer region.

Note 1 — If the outer bound of the Fraunhofer region approaches infinity, the Fresnel region is identical to the radiating near field.

Note 2 — The extent of the Fresnel region is dependent on the electrical size of the antenna.

2.6 Re-radiation, Secondary Radiation — Radiation from conductive or dielectric body excited by an incident radio wave, and which is superimposed upon this wave.

2.7 Polarization of an Antenna (In a Given Direction)

2.7.1 In transmission that polarization of the wave radiated by an antenna in the *far field region* and in a given direction.

2.7.2 In reception, that polarization of a plane wave of given power density incident from given direction, which results in maximum available power at the antenna terminals.

Note — If no direction is specified, the direction is assumed to be that of maximum transmitted or received power.

2.8 Polarization Match — The condition that exists when a plane wave, incident upon an antenna from a given direction, has a polarization which is the same as the polarization of the receiving antenna in that direction.

2.9 Field Strength-Distance Product, Cymomotive Force (CMF) (In a Given Direction) — For any point along a given direction in the far-field region of a transmitting antenna, the product of the distance from the antenna and the electric field vector produced by the antenna at that point.

Note 1 — The field strength at a distance of one kilometre expressed in milivolts per metre, is numerically equal to the magnitude of the field strength-distance product expressed in volts.

Note 2 — The field strength-distance product in any given direction depends on the electrical characteristics of the antenna and the power fied to it.

Note 3 — The field strength-distance product is independent of distance in any given direction.

Note 4 — The term 'cymomotive' force is used in the International Radio Consultative Committee (CCIR).

2.10 Specific Field Strength-Distance Product Specific Cymomotive Force (SCMF) (In a Given Direction) — Field strength-distance product produced in a given direction when the power supplied to the antenna is one kilowatt.

2.11 Radiation Pattern — The distribution in space of a quantity characterizing the radiation from an antenna.

NOTE 1 — The distribution in the far field region is most frequently considered.

NOTE 2 — The quantities characterizing the radiation may be for instance the magnitude and phase of a specified component of the electromagnetic field or field strength-distance product, the radiation intensity, the directivity, the absolute gain or a relative gain.

2.12 Radiation Pattern (Mathematical Representation) — A mathematical expression giving the radiation pattern of an antenna in terms of spatial coordinates.

2.13 Radiation Pattern (Surface) — The surface described by the extremity of a radius vector whose magnitude is proportional to the magnitude of a component of the field produced by an antenna at a constant distance in the direction of the vector.

NOTE — The radiation pattern surface in the far field region is most frequently considered.

2.14 Radiation Pattern (Graphical Representation) — Radiation Diagram — A graphical representation of a radiation pattern of an antenna.

NOTE — For example, a radiation pattern may be a plot of the magnitude of a far field component at a given distance from the antenna as a function of the spherical coordinates, in rectangular or polar format, or alternatively contours of equal values far field component at a given distance from the antenna.

2.15 Array Factor — A multiplying factor which, when applied to the radiation pattern of a single radiating element, gives the radiation pattern of an entire array, provided that the:

a) elements are congruent under translation; and

b) radiation patterns of all the elements, when imbedded in the array, can be assumed to be identical.

NOTE — The array factor may be considered to be the radiation pattern of an array antenna when the array elements are replaced by instropic radiators.

2.16 Phase Pattern — The distribution in space of the phase of a specified component of the field produced by an antenna, with respect to a specified reference phase.

NOTE — In the far field region, the phase is generally determined over a sphere whose centre is defined with respect to the antenna.

2.17 Phase Pattern (Mathematical Representation) — A mathematical function expressing the phase pattern of an antenna in terms of spatial coordinates.

2.18 Phase Pattern (Graphical Representation), Phase Diagram — A graphical representation of the phase pattern of an antenna.

2.19 Phase Centre — The location of a point associated with an antenna, if it exists, such that, when it is taken as the centre of a sphere or a circle, the phase of a given field component in the far field region remains essentially constant at least over that portion of the surface of the sphere or over an arc of the circle where the radiation is significant.

NOTE — Some antennas have different phase centres dependent on the plane containing the circle being considered.

2.20 Co-polar Pattern (of an Antenna) — The radiation pattern of an antenna corresponding to that polarization for which the antenna was designed.

2.21 Cross-polar Pattern (of an Antenna) — The radiation pattern of an antenna corresponding to the polarization orthogonal to that of the co-polar pattern.

2.22 Polarization Decoupling Ratio (of an Antenna), Cross Polarization Discrimination Ratio (of an Antenna) — The ratio, generally expressed in decibels, of a field component radiated with the polarization for which an antenna was designed to the corresponding component radiated with orthogonal polarization in the same direction.

2.23 Radiation Lobe — A part of a radiation pattern bounded by relatively low values and over which there is no deep minimum.

2.24 Major Lobe, Main Lobe — For the intended polarization, the radiation lobe of an antenna which includes the direction in which the radiation intensity has the largest values.

NOTE — Certain antennas have more than one major lobe.

2.25 Secondary Lobe, Minor Lobe — Any radiation lobe other than major lobe.

2.26 Back Lobe — A secondary lobe, the axis of which makes an angle of approximately 180 degrees with the forward direction of the axis of the major lobe of an antenna, by extension, a radiation lobe in the half space opposed to the direction of maximum radiation intensity.

2.27 Side Lobe — Any secondary lobe other than back lobes.

2.28 (Relative) Side-Lobe Level (For a Specified Polarization) — The ratio, usually expressed in decibels, of the maximum radiation intensity corresponding to a specified polarization in a side lobe to the maximum value in a reference lobe.

NOTE — If it is not specified, the reference lobe is the major lobe.

2.29 Side-lobe Suppression — Any process, action or adjustment to reduce the side lobe levels.

2.30 (Main) Beam (of an Antenna) — The major lobe of directional antenna or the radiation contained in that lobe.

NOTE — The concept of beam usually applies to fairly high-gain antennas.

2.31 Directional Null — A specified deep minimum in the radiation pattern of an antenna.

2.32 Beam Axis (of an Antenna) — The direction within the beam of an antenna for which the radiation intensity is a maximum or about which the beam may be considered symmetrical.

2.33 Beam Width — The angle between two directions in a plane containing the maximum radiation intensity within the beam, or a radiation lobe of an antenna for which the radiation intensity for the specified polarization is a given fraction of its maximum value in the plane.

NOTE — The most generally used beamwidth are half-power beamwidth and the beamwidth between the adjacent minimums.

2.34 Electrical Boresight (of an Antenna) — The tracking as determined by an electrical indication such as null direction of a conical scanning or mono-pulse antenna system or the beam maximum direction of a highly directive antenna.

2.35 Reference Boresight (of an Antenna) — An axis of an antenna established as a reference for alignment of its electrical boresight.

2.36 Boresight Error (of an Antenna) — The angular deviation of the electrical boresight of an antenna from a specified reference boresight.

2.37 Squint — A property of an antenna such that the beam axis or the directional null departs slightly from a specified axis such as the direction perpendicular to the aperture or the intended direction of the beam axis or directional null of the antenna.

NOTE — Squint is often the undesired result of a defect in an antenna; but, in certain cases, it is intentionally designed to satisfy an operational requirement.

2.38 Squint Angle — The augular deviation of the beam axis or directional null of an antenna from the corresponding desired direction.

2.39 Radiation Intensity, Radiant Intensity (from a Source in a Given Direction) — In a given direction and in the far field region, the power radiated per unit solid angle by an antenna.

NOTE 1 — The radiation intensity is expressed in watts per steradian.

NOTE 2 — For the polarized waves, the radiation intensity may be considered to be the vector sum of radiation intensities of two orthogonally polarized waves.

2.40 Directivity (of an Antenna) (in a Given Direction) — The ratio, generally expressed in decibels, of the radiation intensity produced by an antenna in a given direction to the value of the radiation intensities averaged in all directions in space.

NOTE 1 — If no direction is specified, the direction of maximum radiation intensity is implied.

NOTE 2 — The directivity is independent of antenna losses and equal to the absolute gain in the same direction if the antenna is lossless.

2.41 (Absolute) Gain (of an Antenna) (in a Given Direction) Isotropio Gain (of an Antenna) (in a Given Direction) — The ratio, generally expressed in decibels, of the radiation intensity produced by an antenna in a given direction to the radiation intensity that would be obtained if the power accepted by the antenna were radiated equally in all directions.

NOTE 1 — If no direction is specified, the direction of maximum radiation intensity from the given antenna is implied.

NOTE 2 — If the antenna is lossless, its absolute gain is equal to its directivity in the same direction.

2.42 Partial Gain (of an Antenna for a Given Polarization) — The ratio, generally expressed in decibels, of that part of the radiation intensity in a given direction, corresponding to a given polarization, to the radiation intensity that would be obtained if the power accepted by the antenna were radiated equally in all directions.

NOTE 1 — If no direction is specified, the direction of maximum radiation intensity from the given antenna is implied.

NOTE 2 — The absolute gain of an antenna is the sum of the partial gains, expressed as power ratios, for any two orthogonal polarizations.

2.43 Relative Gain (of an Antenna with Respect to that of a Reference Antenna) — The ratio, generally expressed in decibls, of the partial gain of a given antenna in a specified direction to the maximum absolute gain of a reference antenna having the polarization corresponding to that of the partial gain of the given antenna.

NOTE 1 — When the reference antenna has in the same direction the same polarization as that of the given antenna, the relative gain is the ratio of the absolute gains.

NOTE 2 — If no direction is specified, the direction is assumed to be that of maximum radiation intensity from the given antenna.

NOTE 3 — A lossless half-wave dipole, elementary electric dipole or very short vertical monopole are frequently used as reference antennas.

2.44 Partial Effective Area (of an Antenna for a Given Polarization and Direction) — In a given direction, the ratio of the available power at the terminals of a receiving antenna to the power flux density of a plane wave of specified polarization incident on the antenna from that direction.

NOTE 1 — If no direction is specified, the direction corresponding to maximum available power is implied.

NOTE 2 — In free space, for a given polarization and direction, the partial effective area A_{ep} of an antenna used for reception is related to the partial gain G_p of the same antenna used for transmission, by the equation:

$$G_p = 4\pi A_{ep}/\lambda^2$$

where λ is the wavelength.

2.45 (Total) Effective Area (of an Antenna for a Given Direction) — In a given direction the ratio of the available power at the terminals of a receiving antenna to the power flux density of a plane wave incident from that direction, the wave being polarization matched to the antenna.

NOTE 1 — If no direction is specified, the direction corresponding to maximum available power at the terminals is implied.

NOTE 2 — The total effective area is the sum of the partial effective areas for any two orthogonal polarizations of components of the antenna polarization.

NOTE 3 — In free space, the effective are A_e for a given direction of an antenna, when used for reception, is related to the absolute gain G for the given direction when the same antenna is used for transmission by the equation:

$$G = 4\pi A_e/\lambda^2$$

NOTE 4 — When an aperture illumination function is uniform in amplitude and phase, and the given direction is perpendicular to the aperture, the total effective area of a radiating aperture of a lossless antenna is equal to its geometric area.

2.46 Scattering Cross-Section (of an Antenna), Scattering Area (of an Antenna) — The ratio of the total power that an isotropic radiator would rediate when producing a radiation intensity equal to that of the re-radiation from a given receiving antenna in a specified direction, to the power flux density of the incident plane wave of specified polarization and direction of propagation.

2.47 Back Scattering Cross-Section (of an Antenna) — Back Scattering Area (of an Antenna) — The scattering cross-section of a receiving antenna for the direction opposite to the direction of propagation of the incident wave.

2.48 Aperture (of an Antenna): Radiating Aperture (of an Antenna) — A plane surface close to the antenna and normal to the direction of maximum *radiation intensity* through which the major part of the radiated power passes.

NOTE — For certain types of antennas such as *horns* or *paraboloiral reflectors*, the aperture differs only slightly from the antenna.

2.49 Aperture Illumination (Function) — A mathametical expression giving the amplitude, phase and polarization distribution of the electromagnetic field at each point on the aperture of an antenna.

2 50 Illumination Pattern: Illumination Diagram — A graphical representation of the distribution of the electromagnetic field over the aperture of an antenna.

2.51 Tapered Distribution (of a Field Over an Aperture) — Cabled Distribution (of a Field Over an Aperture) — A distribution of the electromagnetic field over an aperture such that the magnitude of the aperture illumination decreases from the centre to the edges.

2.52 Aperture Illumination Efficiency — For an antenna with a specified aperture illumination, the ratio of its peak directivity when the aperture illumination is uniform in polarization, amplitude and phase with the same total radiated power.

2.53 Antenna Efficiency (for an Aperture-Type Antenna) — For an aperture-type antenna with a specified aperture illumination, ratio of the maximum total effective area to the geometric area of the aperture.

2.54 Spill-over Power — For a reflector antenna, that part of the power radiated to a reflector but is not intercepted by it.

2.55 Spill-over Factor; Feed Efficiency — For a reflector antenna, the ratio of the power intercepted by a reflector to the power that is radiated to this reflector.

NOTE — If an antenna includes a succession of reflectors, a spill-over factor may be considered for each reflector.

2.56 Aperture Blockage — The effect of objects lying in the path of rays arriving at or departing from a radiating element or the aperture of an antenna.

NOTE — For example, the feed, sub-reflector or support structure produce aperture blockage for a symmetric reflector antenna.

2.57 Aperture Blocking Factor (in a Reflector Antenna) — The relative reduction in effective area of a reflector antenna due to the masking effect of antenna parts, such as the feed, struts and sub reflector.

2.58 Radiation Efficiency (of an Antenna) — The ratio of the total power radiated by an antenna to the net power accepted by the antenna from the corrected transmitter.

2.59 Equivalent Isotropically Radiated Power (in a Given Direction; E.I.R.P) (Abbreviation) — The product of the power supplied to an antenna and the absolute gain of the antenna in a given direction.

2.60 Effective Radiated Power (in a Given Direction); E.R.P. (Abbreviation) — The product of the power supplied to an antenna and the relative gain of the antenna in a given direction, with respect to a half-wave dipole.

NOTE — The use of the concept of equivalent isotropically radiated power is to be preferred to that of effective radiated power.

2.61 Effective Monopole Radiated Power (in a Given Direction); E.M.R.P (Abbreviation) — The product of the power supplied to an antenna and the relative gain of the antenna in a given direction with respect to a short vertical antenna.

2.62 Noise Temperature (of a Receiving Antenna) — The temperature, usually expressed in Kelvins, of a resistor having an available thermal noise power per unit bandwidth equal to that at the output port of a given antenna installed and operating at a specified frequency in specified conditions.

NOTE — The noise temperature of an antenna depends on the intrinsic noise of the antenna and on the noise from external sources.

2.63 Figure of Merit (of an Antenna) *G*/*T* (Abbreviation) — The ratio, usually expressed in logarithmic units, of the absolute gain G of an antenna to its noise temperature, T referred to the antenna terminals at a specified frequency and in specified conditions of operation.

NOTE — If the noise temperature is expressed in Kelvins and the gain as a power ratio, the quantity $10 \log G/T$ is expressed in a unit designated by the symbol *dBK*.

2.64 Figure of Merit (of an Antenna-Receiving System) *G*/*T* (Abbreviation) — The ratio, usually expressed in logarithmic units, of the absolute gain G of an antenna to the antenna-receiver noise temperature referred to the antenna terminals at a specified frequency and in specified conditions of operation.

NOTE — If the noise temperature is expressed in Kelvins and the gain as a power ratio, the quantity $10 \log G/T$ is expressed in a unit designated by the symbol *dBK*.

2.65 Antenna Current — For an antenna, where each radiating element may be considered to be a single wire, the total current at a specified point along a wire, usually at the feed point or at a current standing-wave maximum.

2.66 Sinusoidal Distribution (of a Current in an Antenna) — For an antenna, where each radiating element may be considered to be a single wire, a hypothetical distribution of current along a wire such that the current amplitude is a sinusoidal function of the distance.

2.67 Antenna Wavelength — Twice the distance between two adjacent current nodes on antenna or a radiating element which may be considered to be a single wire in which a standing wave exists.

2.68 Electrical Length (of a Radiating Element) — Length of a radiating element expressed as a fraction of the antenna wavelength.

2.69 Wavelength Reduction Factor — The ratio, expressed in percentage, of the difference between wavelength in vacuum and antenna wavelength, to the wavelength in vacuum.

2.70 Cold Point (of a Radiating Element) — A point on a radiating element which may be considered to be at ground or frame potential.

2.71 Antenna (Input) Impedance — The complex impedance of an antenna appearing at the feed point terminals.

NOTE — The antenna impedance may be described in terms of the reflection coefficient or of the standing wave ratio on the feed line associated with the antenna.

2.72 Antenna (Input) Admittance — The complex admittance of an antenna appearing at the feed point terminals.

NOTE — The antenna admittance may be described in terms of the reflection coefficient or of the standing wave ratio on the feed line associated with the antenna.

2.73 Mutual Impedance (of Antenna Elements) — The mutual impedance between any two terminal pairs in a multi-element array antenna is equal to the open-circuit voltage produced at the first terminal pair divided by the current applied to the second. when all other terminal pairs are open-circuited.

2.74 Self Impedance (of Antenna Elements) — The input impedance of a radiating element of an array antenna with all other elements in the array open-circuited.

NOTE — Strictly speaking, the self-impedance of an array element is not equal to its isolated impedance. However, in many arrays, the element spacing is such that it is approximated quite well by the isolated impedance.

2.75 Radiation Resistance (of an Antenna) — The ratio of the total power radiated by an antenna to the square of the effective value of the antenna current at a given point, usually the feed point or a current standing-wave maximum.

2.76 Effective Length (of an Antenna): Effective Height (of an Antenna) — For a linearly polarized antenna receiving a plane wave, the ratio of the magnitude of the open circuit voltage developed at the terminals of the antenna, to the magnitude of that component of the electric field strength in the direction of the antenna polarization.

2.77 Image Antenna — A hypothetical antenna symmetrical with an actual antenna with respect to a plane, and traversed by electric currents of the same instantaneous value as the actual currents at the points of symmetry, the current components having the same direction as the actual currents when normal to the plane and the opposite directions when parallel.

NOTE — The combination of the actual antenna and the image antenna will produce the same radiation pattern above the plane as the combination of the actual antenna and the plane if the later is a perfect conductor.

2.78 Bandwidth (of an Antenna) — The width of the frequency band within which the variations of specified characteristics of an antenna do not exceed specified limits.

NOTE — The characteristics may include input impedance, directivity, radiation pattern or phase pattern.

2.79 Isolation Ratio (of a Multiport Antenna) — The ratio, generally expressed in decibels, of the incident power at one port of a multiport antenna, to the available power produced at another port by that incident power.

2.80 Discrimination Ratio (of an Antenna Between Two Received Waves) — The ratio, generally expressed in decibels, of the power available at the terminals of a receiving antenna from the desired electromagnetic wave, to the available power resulting from an undesired wave having the same field strength but differing by some other specified characteristic such as direction of propagation, polarization, signal frequency.

2.81 Superdirectivity — A condition that occurs when an antenna's directivity significantly exceeds that obtained from an aperture of the same dimension as that of the actual antenna but with uniform aperture illumination or, in the case of an array, from the array with elements uniformly excited.

NOTE — Most frequently superdirectivity can be obtained only when amplitude and phase of currents, or field on the aperture vary rapidly over distance short compared to the wavelength, which may lead to a very poor efficiency and usually renders the use of this property impractical.

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

Section 3 Terms Relating to Types of Antennas Defined by Their Electrical or Radiating Characteristics

(First Revision)

1. SCOPE

1.1 This standard (Part 21/Sec 3) (First Revision) covers definitions of terms relating to types of antennas defined by their electrical or radiating characteristics.

2. TERMINOLOGY

2.1 Isotropic Radiator — A hypothetical antenna, without loss, having equal radiation intensities in all directions and serving as a convenient reference for expressing the directional properties of actual antennas.

2.2 Directional Antenna — An antenna designed to provide significantly higher or lower radiation intensities in specified directions than in other directions.

NOTE — The term is usually applied to an antenna whose maximum directivity is significantly greater than that of a halfwave dipole.

2.3 Directional-null Antenna — A directional-null antenna designed to provide one or more directional null in its radiation pattern.

2.4 Null-steering Antenna — A directional-null antenna having in its radiation pattern one or more nulls that can be steered, generally by electrical means.

2.5 Single-polarized Antenna — An antenna intended to radiate or receive radio waves with only one specified polarization.

2.6 Dual-polarized Antenna — An antenna intended to radiate or receive simultaneously two independent radio waves orthogonally polarized.

2.7 Omnidirectional Antenna (in a Given Plane) — An antenna having an essentially non-directional radiation intensity in a given plane, usually horizontal, referred to specified polarization.

2.8 Broadside Array — A linear array or a planar array whose direction of maximum radiation is perpendicular or nearly perpendicular to the line or plane, respectively of the array.

NOTE — By extension, the qualification broadside is applied also to large aperture antennas.

2.9 End-fire Array — A linear array whose direction of maximum radiation intensity lies along the line of the array.

NOTE — By extension the qualification end-fire is applied also to antennas having an elongated form a direction along which the radiation is maximum.

2.10 Back-fire Antenna — An antenna with a feed consisting of one or more radiating elements and a reflector element which illuminates a closely spaced reflector, such that the antenna functions as an open resonator with radiation emanating from the open end of the resonator, that is, in the direction opposite to that of the feed.

2.11 Rotating-field Antenna — An omnidirectional antenna such that the value of its phase pattern for any direction in the horizontal plane is practically equal to the angle characterizing this direction.

2.12 Shaped-beam Antenna — An antenna which is designed to have a prescribed radiation pattern differing significantly from that obtained from a uniform amplitude and phase aperture illumination of the antenna.

2.13 Contoured-beam Antenna — A shaped-beam antenna designed in such a way that, when its beam intersects a given surface, the lines of equal power flux density incident upon the surface form specified contours.

NOTE — The lines of equal power flux density on the ground are called footprints of the beam.

2.14 Fan-beam Antenna — An antenna having a beam whose transverse cross-section has a large ratio of major to minor dimension.

2.15 Beaver-tail Beam Antenna — A fan-beam antenna in which the beamwidth in the horizontal plane is significantly greater than in the vertical plane.

2.16 Pencil-beam Antenna — An antenna having a narrow beam that is approximately circular in transverse cross-section.

2.17 Cosecant-square Beam Antenna — A shaped-beam antenna for which part of its radiation pattern in one plane is such that the radiation intensity is proportional to the square of the cosecant of the angle measured from a specified direction in the plane.

NOTE — In radar applications, the plane is vertical and the angle is measured from the horizontal so that objects with the same backscattering cross-section at the same altitude give equal response regardless of distance.

2.18 Multi-beam Antenna; Multi-pattern Antenna — An antenna with several independent ports, having simultaneously several different radiation patterns, each pattern corresponding to a different port.

2.19 Steerable-beam Antenna — An antenna in which the direction of the main lobe can be changed either by controlling the excitation of the different elements or by mechanical means other than moving the entire antenna.

2.20 Phased Array Antenna — A steerable beam antenna whose beam diretion or radiation pattern is controlled primarily by the relative phase of excitation of the different radiating elements of an array.

2.21 Scanning Antenna — An antenna whose beam regularly scans a certain sector of space.

2.22 Multimode Antenna — An antenna, generally of electromagnetic horn type, whose aperture is illuminated by two or more waveguide type modes of propagation.

NOTE — Often this type of antenna is used when nearly identical *E* and *H* plane radiation patterns are required.

2.23 Anti-jamming Array — A receiving array whose radiation pattern may be adjusted to reduce or eliminate in-band jamming or interference.

2.24 Reversible Antenna — A directive antenna such that the direction of the major lobe may be reversed by changing the feeding arrangements.

2.25 Split Antenna — An antenna consisting of two groups of radiating elements having identical radiation properties and fed either in parallel or separately.

NOTE — With such an antenna, transmission may be continued on one group when the other group happens to be faulty.

2.26 Slewing (Array) Antenna — A planer array capable of being adjusted so that the axis of the main lobe makes an angle, generally small, with a plane of symmetry of the array.

2.27 Broadband Antenna; Wide-band Antenna — An antenna having acceptable characteristics over a wide range of radio frequencies.

2.28 Frequency Independent Antenna — Any of a class of extremely broadband antennas which possess the property that the lower and upper limits of the band over which their impedance and radiation pattern remain almost constant are fixed respectively by the antenna's maximum physical size and by the minimum spacing at the feed point.

NOTE — The equiangular spiral antenna and log-periodic antenna are notable examples of frequency independent antennas.

2.29 Active Antenna — An antenna incorporating active devices in an integrated way.

2.30 Signal Processing Antenna — An antenna system incorporating active circuits associated with radiating elements which perform on received signals functions, such as multiplication, storage, correlation and time modulation.

2.31 Adaptive Antenna System — An antenna system incorporating active circuits associated with radiating elements whereby one or more of the characteristics of the antenna are automatically modified in a prescribed manner as a function of the received signal or changes in its electromagnetic environment.

2.32 Low Noise Antenna; Low Temperature Antenna — A low loss antenna which is usually very directive and whose side lobes are reduced in such a way as to lower its noise temperature when the major lobe is directed above the horizon.

2.33 Surface-wave Antenna — An end-fire antenna whose radiation may be considered to be generated by a slow wave travelling along the surface of the antenna or a virtual surface associated with the antenna.

2.34 Leaky-wave Antenna — An antenna that couples power in small increments per unit length, either continuously or discretely from a travelling wave structure to free space.

2.35 Multiple-band Antenna — An antenna designed to operate without modification in any of a number of pre-set radio-frequency bands.

2.36 Balanced Antenna — A symmetrical antenna designed in such a way that it may be fed directly from an unbalanced line without interposition of a separate balun; this antenna contains a virtual earth point.

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

Section 4 Terms Relating to Antennas and Antenna Elements Consisting Mainly of Radiating Conductors

(First Revision)

1. SCOPE

1.1 This standard (Part 21/Sec 4) (First Revision) covers definitions of terms relating to antennas and antenna elements consisting mainly of radiating conductors.

2. TERMINOLOGY

2.1 Hertzian (Electric) Dipole : (Elementary) Electric Dipole: Infinite Simal Dipole — A hypothetical radiating element consisting of a conductor of vanishingly small length traversed by a time-varying electric current having at any instant the same value at all points.

Note — The continuity conditions relating current to charges require that opposite ends of the current element be terminated by equal and opposite electric charge, these charges being also time-varying. The field of the Hertzian dipole can be computed either from the current or from the charges.

2.2 Hertzian Magnetic Dipole (Elementary) Magnetic Dipole — A hypothetical radiating element consisting of a closed loop of vanishingly small dimensions traversed by a time-varying current having at any instant the same value at all points.

Note — The radiation from this element is the same as that from a fictitious time-varying magnetic current element perpendicular to the plane of the loop.

2.3 Driven Element: Fed Element — A radiating element which is joined to a radio transmitter or to a radio receiver directly or by a feed line.

2.4 Parasitic Element: Non-driven Element — A radiating element which is not joined to a radio transmitter or to a radio receiver directly or through a feed line and which is coupled to the driven elements only by the electromagnetic fields.

2.5 Reflector (Element) (of an Antenna) — A radiating element generally located to the rear of one or more driven elements with respect to the desired direction of radiation so as to increase radiation in that direction and to reduce it in other directions.

Note — The term 'reflector' may be used also for a reflecting surface.

2.6 Director Element (of an Antenna) — A radiating element located in front of a driven element, with respect to the desired direction of radiation so as to increase radiation in that direction.

2.7 Multi-wire Element : Multi-conductor Element — A radiating element composed of several wires spaced from each other and connected in parallel, the assemblage being the electrical equivalent of a single conductor of large cross-section.

2.8 Equivalent Radius (of a Conductor) — The radius of cylindrical conductor of circular cross-section having the same values for certain electrical characteristics as those of a conductor of arbitrary cross-section.

2.9 Equivalent Radius (of a Multi-wire Element) — The radius of a cylindrical conductor of circular cross-section having the same values for certain electrical characteristics as those of a multi-wire element.

2.10 Cage Antenna — A multi-wire element whose wires are so disposed as to resemble a cylinder, in general, of circular cross-section, for example, an elongated cage.

2.11 Quarter-wave Sleeve Element — A tubular radiating element, usually about a quarter-wave long, coaxially surrounding a conductive supporting cylinder and connected to it at one end.

2.12 Symmetrical Antenna — An antenna constructed from two geometrically symmetrical parts with respect to a plane considered to be a zero potential plane and fed symmetrically with respect to this plane.

2.13 Symmetrical Radiating Element — A radiating element constructed from two geometrically symmetrical parts with respect to a plane considered to be a zero potential plane and fed symmetrically with respect to this plane.

2.14 Dipole (Antenna) : Doublet (Antenna) — A symmetrical antenna composed of conductors usually rectilinear and energized by a balanced feed.

NOTE — The word 'dipole' is sometimes used to describe antennas which do not conform in all respects to the above definition. In such cases, the word shall be qualified. Example: Asymetrical dipole.

2.15 Half Dipole; Half Doublet — One of two geometrically symmetrical parts of a dipole antenna.

2.16 Half-wave Dipole — A rectilinear dipole antenna whose total electrical length is about a half wavelength.

2.17 Full-wave Dipole — A rectilinear dipole antenna whose total electrical length is about one wavelength.

2.18 Folded Dipole (Antenna) — An antenna composed of two or more parallel closely spaced conductors usually connected together at their ends, with one of the conductors fed across a gap at its centre, the other conductors being without a gap.

NOTE — The term 'folded dipole', when used without qualification, implies in most cases the use of two conductors.

2.19 Multiple Folded Dipole — A folded dipole consisting of three or more conductors.

2.20 Loaded Folded Dipole — A folded dipole modified by the addition of conductors or circuit elements (usually resistive) minimize the changes of input impedance with frequency.

2.21 Sleeve-Dipole (Antenna) — A dipole antenna surrounded in its central portion by a coaxial conductive sleeve.

2.22 Sleeve Monopole (Antenna) : Sleeve Stub (Antenna) — An antenna consisting of half a sleeve dipole projecting from a conductive plane surface.

2.23 End Capacitor : Capacity Top (Deprecated) — A conducting element or group of conducting elements, connected at the end of a radiating element of an antenna, to modify the current distribution on the antenna.

2.24 Top-loaded Antenna — An antenna, generally vertical and short compared to its wavelength, incorporating an end capacitor.

2.25 Series-loaded Antenna — An antenna whose radiating elements include one or more reactances in series to modify the current distribution.

2.26 Monopole (Antenna) : Unipole (Antenna) — An antenna composed of one or more conductors usually rectilinear, and a conductive surface, the antenna being energized between the conductive surface and the near end of the element by an unbalanced feed to produce a current standing wave.

2.27 Folded Monopole (Antenna); Folded Unipole (Antenna) — A monopole antenna formed from half a folded dipole, with the unfed element directly connected to the conductive surface.

2.28 Vertical Monopole (Antenna); Vertical Unipole (Antenna) — A monopole antenna vertically oriented for which the conductive surface is the earth whose conductivity in the vicinity of the antenna is enhanced by a ground system or a counterpoise.

2.29 Ground-plane Antenna — A monopole antenna for which the conductive surface only consists of a system of radially disposed rods or a disc.

2.30 Ground System (of an Antenna); Earth System — A system of conductors, located on or in the ground, to enhance the conductivity of the ground in the vicinity of an antenna.

2.31 Counterpoise — A system of conductors, elevated above and capacitively coupled to the ground, to provide the conductive surface for a vertical monopole antenna.

2.32 Earth Mat; Ground Mat — A conductive sheet or a system of conductors arranged in the form of a grid or mat located on the ground, to provide a conductive plane surface for an antenna.

2.33 Loop Antenna — An antenna whose configuration is that of a loop with one or more turns.

2.34 Shielded-loop Antenna — An antenna consisting of a tubular electrostatic shield formed into a loop with a small gap and containing one or more wire turns for external coupling.

2.35 Magnetic Core Antenna — An antenna with several turns of wire around a magnetic core and acting as a loop antenna.

2.36 Ferrite Rod Antenna — An antenna with several turns of wire around a magnetic ferrite rod and acting as a loop antenna.

2.37 Quardrant Antenna — A symmetrical antenna having two equal conductive elements forming a horizontal right-angled 'V' and having an essentially omni-directional radiation pattern.

2.38 Alford Loop (Antenna) — An omni-directional antenna consisting of four insulated conductors, each one-half wavelength long, positioned in the form of a square in a horizontal plane and symmetrically fed by balanced lines at two diagonally opposite corners of the square.

2.39 Rhombic Antenna — A symmetrical travelling wave antenna composed of long-wire radiators forming the sides of a rhombus with a balanced feed at one end and terminated by an appropriate impedance at the other end.

2.40 Biconical Antenna — An antenna consisting of two conical conductors having a common axis and vertex.

2.41 Discone — An axially symmetric antenna consisting of a conductive cone and a disk with the vertex of the cone close to the centre of the disk, the antenna being fed across this gap.

2.42 Coaxial Antenna — An antenna comprising an extension to the inner conductor of a coaxial line and a quarter wave sleeve element which is formed by folding back the outer conductor of the coaxial line.

2.43 Long-wire Antenna — A wire antenna which is long in comparison with the operating wavelength and is fed at one end.

2.44 Flat-top Antenna — A short vertical monopole antenna with an end capacitor whose elements are all in the same horizontal plane.

2.45 Umbrella Antenna — A short vertical monopole antenna, with an end capacitor whose elements slope down towards the ground but are not connected to it.

NOTE — An umbrella antenna is different from an umbrella reflector antenna.

2.46 Intermediate Feed Antenna — A vertical antenna with one end close to the ground, and fed at a point whose position with respect to the base is selected to give the antenna specified characteristics.

2.47 Whip Antenna — A thin flexible monopole antenna used, for example, on vehicle or portable equipment.

2.48 Clover-leaf Antenna — An antenna formed from one or more radiating elements arranged along a common axis, each consisting of three or four loops arranged in a plane around the axis so that the overall shape is similar to a three-leaf or four-leaf clover.

2.49 Turnstile Antenna — An antenna formed from one or more radiating elements arranged along a common axis, each consisting of two dipoles perpendicular to the axis and to each other with their axis intersecting at their mid-points and fed in phase quadrature.

2.50 Fishbone Antenna — An end-fire antenna consisting of an array of indentical dipoles which are closely spaced in a plane and loosely coupled to a balanced transmission line.

2.51 H-Antenna — An antenna composed of two parallel dipoles which together with their common support are in the form of the letter H.

2.52 Inverted L Antenna — A monopole antenna consisting of one conductor perpendicular to the conducting surface, connected at its unfed end to the end of a conductor parallel to that surface; each of the two conductors may consist of several wires.

2.53 T Antenna — A monopole antenna consisting of one conductor perpendicular to the conducting surface, connected at the unfed end to the mid-point of a conductor parallel to that surface; each of the two conductors may consist of several wires.

2.54 Inclined V Antenna — A symmetrical travelling-wave antenna consisting of two conductors forming a V in a plane inclined to the horizontal, fed at the apex of the V, the highest point of the antenna, the two ends being connected to the ground through appropriate impedances.

2.55 Inverted V Antenna — A travelling-wave antenna consisting of a conductor in the form of an inverted V located in a vertical plane with one extremity being fed and the other connected to the ground through an appropriate impedance.

2.56 Adcock (Array) Antenna — A directional-null receiving antenna designed to be insensitive to the horizontal components of the electric field, formed from one or more pairs of vertical radiating elements regularly spaced on a horizontal circle, the diametrically opposite elements being connected in phase opposition, all pairs of elements being coupled to a common output through the field coils of a radiogoniometer to obtain a steerable directional null.

2.57 Bellini-Tosi Antenna — A directional-null receiving antenna consisting of two fixed crossed vertical loops at right angles to each other and coupled to a common output through the field coils of a radiogoniometer to obtain a steerable directional null.

2.58 Beverage Antenna — A travelling-wave receiving antenna composed of a long horizontal conductor relatively near a ground of poor conductivity, connected to the receiver at one end, oriented in the direction of the transmitter and connected to ground through an appropriate impedance at the far end.

2.59 Curtain Antenna — A broadside planer array in which the radiating elements usually consisting of wires are arranged within a vertical plane.

NOTE — Generally, a curtain antenna is used with an array of reflector elements.

2.60 Dipole-curtain Antenna — A curtain antenna comprising parallel dipoles with a length of either a half or a full wavelength, essentially horizontal and spaced approximately half a wavelength apart in a vertical plane.

2.61 Chireix-Mesny Antenna — A curtain antenna consisting of conductors having the form of right-angled symmetrical saw-tooths with sides of half a wavelength.

2.62 Franklin Antenna — A curtain antenna comprising vertical end-fed radiating elements, each of which consists of a conductor folded or loaded by series reactances at regular intervals so that the radiation from all parts of it is in phase.

2.63 Panel for Radiating Dipoles — A panel whose radiating elements are dipoles.

2.64 Yagi-Uda Antenna : Yagi Antenna — An end-fire array consisting of a driven element, one reflector element and one or more director elements.

NOTE — In practice, the reflector element may consist of an assembly of elements or a reflecting surface.

2.65 Helix Antenna — An antenna consisting of a conductor in the form of a helix and designed to radiate either along the axis of the helix or perpendicular to it.

NOTE — For axial radiation, the helix is arranged with its axis perpendicular to a plane reflector and fed at the reflector end.

2.66 Log-periodic Antenna — A frequency-independent antenna which consists of radiating elements whose dimensions and spacings are approximately proportional to the terms of a geometric series.

2.67 Equiangular Spiral Antenna — A frequency independent antenna whose conducting surfaces have shapes generated by equiangular spirals having a common axis and the same defining parameter.

NOTE 1 — The antenna usually has two arms fed by a balanced feedline. It may have multiple pairs of arms. A common design requires two pairs oriented 90° apart about their common axis and fed in phase quadrature.

NOTE 2 — The arms of the spirals can confirm to planer or conical surfaces in which case they are confined to a planer or conical equiangular spiral antennas respectively.

NOTE 3 — These antennas are usually designed so that the nonconducting portion of the surface to which the antenna conforms is of the same shape and size as the spiral arms. This design is said to be self-complementary.

2.68 Multiple-unit Steerable Array : Musa Antenna — A linear array of identical rhombic antennas, the outputs of which are combined with adjustable phase delays so as to give steerable directional properties in the vertical plane of symmetry.

2.69 Chebyshev Array : Dolph-Chebyshev Array — An array antenna with uniform element spacing and excitation coefficients chosen such that the array factor can be expressed as a Chebyshev polynomial whose order is the number of elements minus one.

NOTE — The array factor of a Chebyshev array is such that all the side lobes have the same level.

2.70 Microstrip Antenna — An antenna which consists of a thin metallic conductor bonded to a thin dielectric substrate which is, in turn, bonded to a ground plane.

2.71 Standing Wave Antenna — An antenna for which the fields and currents that produce the radiation pattern can be represented by two or more travelling waves propagating along the antenna in both directions.

2.72 Travelling Wave Antenna — An antenna for which the fields of currents that produce the radiation pattern can be represented by a travelling wave propagating in one direction along the antenna.

Indian Standard

ELECTROTECHNICAL VOCABULARY

PART 21 ANTENNAS

Section 5 Terms Relating to Antennas and Antenna Elements Consisting Mainly of Radiating Surfaces and Apertures

(First Revision)

1. SCOPE

1.1 This standard (Part 21/Sec 5) (First Revision) covers definition of terms relating to antenna elements consisting mainly of radiating surfaces and apertures.

2. TERMINOLOGY

2.1 Reflector: Reflecting Surface — A conductive surface for conductive assembly which acts as a practically continuous surface, whose dimensions are large compared to the wavelength, used to reinforce or divert the incident radiation in desired directions.

NOTE — The term 'reflector' may be used also for a *reflector element*.

2.2 Passive Reflector — A reflector, generally not an active part of an antenna, designed to direct the incident radiation into a desired direction.

2.3 Focusing Reflector — A *reflector* whose shape is such that, when it is fed from one or more *primary radiators*, the reflected energy is focused to a given point or a given direction.

2.4 Reflector Antenna — An antenna comprising at least one *reflector*.

NOTE — The use of the term 'reflector antenna' is generally restricted to those cases where most of the radiated power emanates from a properly illuminated reflector.

2.5 Main Reflector — The largest *reflector* of a multiple *reflector antenna*.

2.6 Sub-Reflector — A reflector other than the *main reflector* of a *multiple reflector antenna*.

2.7 Lattice Reflector — A *reflector* composed of parallel reflecting rods or strips.

2.8 Paraboloidal Reflector — A *reflector* which is a portion of the surface of a paraboloid.

2.9 Cylindrical Reflector — A *reflector* which is a portion of the surface of a cylinder.

2.10 Spherical Reflector — A *reflector* which is a portion of the surface of a sphere.

2.11 Toroidal Reflector — A *reflector* formed by rotating a plane curve about a non-intersecting coplanar line.

2.12 Parabolic Torus Reflector — A *reflector* formed by rotating a segment of a parabola about a non-intersecting coplanar line perpendicular to its axis.

2.13 Dihedral Corner Reflector — A *reflector* composed of two mutually intersecting conducting flat surfaces; generally at right angle.

2.14 Trihedral Corner Reflector — A *reflector* composed of three mutually intersecting conducting flat surfaces, generally at right angles.

2.15 Spherical Reflector Antenna — An antenna consisting of a *spherical reflector* and a *feed*, and generally including compensation of phase errors in the *reflector aperture*.

2.16 Paraboloidal Reflector Antenna — An antenna consisting of a *paraboloidal reflector* and a *feed* placed in the vicinity of its focus.

2.17 Offset Paraboloidal Reflector Antenna — A *paraboloidal reflector antenna* using a portion of a poraboloid which is not symmetrical with respect to its focal axis, and does not include the vertex so that the *blockage* of the *aperture* by the *feed* is reduced or eliminated.

2.18 Cassegrain Reflector Antenna — A *paraboloidal reflector antenna* with a convex *sub-reflector*, hyperboloidal in shape, located between the vertex and the prime focus of the reflector.

NOTE — To improve the aperture efficiency of the antenna, the shape of the main reflector and sub-reflector are sometimes modified with respect to the ideal paraboloidal and hyperbolical geometrical forms.

2.19 Gregorian Reflector Antenna — A *paraboloidal reflector antenna* with a concave sub-reflector ellipsoidal in shape, located at a distance from the vertex of the *main reflector*, that distance being greater than the prime focal length of the main reflector.

NOTE — To improve the aperture efficiency of the antenna, the shapes of the main reflector and sub-reflector are sometimes modified with respect to the ideal paraboloidal and ellipsoidal geometrical forms.

2.20 Parabolic Cylinder Antenna — A reflector antenna composed of a portion of a parabolic cylinder and one or more *feeds* placed along its focal line.

2.21 Periscope Antenna — An antenna consisting of a very directive *feed* located close to ground level and oriented so that its beam illuminates an elevated *reflector* which is oriented so as to produce a horizontal beam.

2.22 Cheese Antenna — A *reflector antenna* having a *cylindrical reflector* enclosed by two parallel plates perpendicular to the cylinder and spaced more than one wavelength apart.

2.23 Pill-box Antenna — A *reflector antenna* having a cylindrical reflector enclosed by two parallel conducting plates perpendicular to the cylinder, spaced less than one wavelength apart.

2.24 Umbrella Reflector Antenna — An antenna constructed in a form similar to an umbrella which can be mounted in a space vehicle and unfolded in space to form a large *reflector antenna*.

NOTE — An umbrella reflector antenna is different from an *umbrella antenna*.

2.25 Reflective Array Antenna; Reactive Reflector Antenna — An *antenna* consisting of a *feed* and an *array* of *reflecting elements* arranged on a surface and adjusted so that the phase of the reflected wave from each element is such that a prescribed secondary pattern is obtained.

NOTE — The reflecting elements are generally waveguides containing electrical phase shifters and terminated by short circuits.

2.26 Feed (of Reflector or Lens Antennas) — That portion of an antenna which illuminates a *reflector* or *lens*.

NOTE — When an antenna includes a single illuminated lens or reflector, the feed cannot be distinguished from the *primary radiator*.

2.27 Primary Radiator — The *radiating* element of a *reflector* or *lens antenna* which is coupled to the transmitter or receiver directly or through a *feed line*.

NOTE 1 — An antenna may include more than one primary radiator.

NOTE 2 — In the case of a multiple reflector antenna, the primary radiator illuminates a *sub-reflector*.

2.28 Offset Feed — A reflector antenna whose main reflector is a portion of a paraboloid which is not symmertical with respect to its focal axis, and does not include the vertex so that aperture blockage by the feed is reduced or eliminated.

2.29 Vertex Plate (of a Paraboloidal Reflector) — A circular plate placed near the vertex of a paraboloidal reflector and at right angles to its axis in order to reduce the standing waves on the *feed line*.

2.30 Cutler Feed — A *primary radiator* consisting of two radiating slots, one on each side of an axial *feed line*.

2.31 (Radio Wave) Lens — A structure, through which radio waves in a certain frequency range can pass, designed to produce specified convergence of divergence effects.

2.32 Slot Radiator — A *radiating element* formed by a slot in a conducting surface.

2.33 Slot Antenna — An antenna consisting of one or more *slot radiators*.

2.34 Slot Array (Antenna) — An *array antenna* whose elements are *slot radiators*.

2.35 Slotted Cylinder (Antenna) — An antenna formed by one or more *slot radiators* in a conducting cylindrical surface.

2.36 Slotted Waveguide (Antenna) — An antenna formed by one or more slots in the walls of a waveguide.

2.37 Annular Slot Antenna — A slot antenna with the *slot radiator* having the shape of an annulus.

2.38 Bat-wing Antenna — A slot antenna formed from a plane conducting sheet having the shape of a pair of wings connected at both ends to form the slot.

NOTE — The conducting sheet may be approximated by a metal frame and bars perpendicular to the slot.

2.39 Super-turnstile Antenna — An antenna similar to a *turnstile antenna* formed from one or more tiers of *radiating elements* arranged around a common vertical axis each consisting of a pair of *bat-wing antennas* with their vertical slots at right angles and fed in phase quadrature.

2.40 Slotted Panel — A panel whose radiating elements are made up of slot antennas.

2.41 Bat-Wing Panel — A panel whose radiating elements are made up of bat-wing antennas.

2.42 Slotted Cylinder Panel — A panel whose radiating elements are made up of slotted cylinder antennas.

2.43 Cigar Antenna — A surface wave antenna composed of metal discs disposed perpendicularly about a metal support which serves as their common axis and a fed elements at one end.

2.44 Corner Reflector Antenna — An antenna consisting of a dihedral corner reflector with a feed generally in the bisecting plane of the dihedral angle.

2.45 Dielectric Lens — A radio wave lens made of dielectric material.

2.46 Zone Lens-Stepped Lens — A radio wave lens with one or both of its faces divided into zones which are each stepped thus forming a discontinuous surface.

2.47 Fresnel Lens Antenna : Zone Plate Lens Antenna — An antenna consisting of a feed and a lens, usually planer, which transmits the radiated power from the feed through the central zone and alternate Fresnel zones.

2.48 Parallel Plate Lens — A radio wave lens composed of thin parallel conducting plates parallel to the general direction of propagation.

2.49 E-Plane Lens — A parallel plate lens in which the plates are parallel to the electric field vector.

NOTE — The spacing between adjacent plates must be greater than one-half wavelength. Usually they are spaced no greater than one wavelength.

2.50 H-plane Lens — A parallel plate lens in which the plates are parallel to the magnetic field vector.

2.51 Contrained Lens — A *parallel plate lens* in which the waves are guided by the parallel plates, hence the direction of propagation within the lens is independent of the angle of incidence.

2.52 Multicellular Lens : Eggcrate Lens — A *radio wave lens* formed from two sets of parallel plates set perpendicular to each other such that rectangular cells are formed which behave as coupled waveguides in the direction of propagation.

2.53 Perforated Lens — An *artificial dielectric lens* composed of parallel conducting sheets which are held perpendicular to the general direction of propagation and which have perforations of appropriate size and position.

2.54 Luneburg Lens Antenna — An antenna composed of a spherically symmetric dielectric lens, whose index of refraction varies only in a radial direction and a *feed* located on or near the surface of the sphere.

NOTE 1 — There are a number of modified luneburg lenses including an axially symmetric cylindrical lens.

NOTE 2 — The Luneburg lens may be constructed of an artificial dielectric.

2.55 Horn (Antenna) — An antenna consisting of a waveguide section in which the cross-sectional area increases towards an open end which is the *aperture*.

2.56 Ridged (Antenna) — A horn antenna in which the waveguide section is ridged.

2.57 Sectoral Horn (Antenna) — A horn antenna of a rectangular cross-section with two opposite sides parallel and the other two sides flared.

2.58 E-plane Sectoral Horn (Antenna) — A sectoral horn antenna whose two parallel sides are parallel to the electric field of the transverse electric mode employed.

2.59 H-plane Sectoral Horn (Antenna) — A *sectoral horn antenna* whose two parallel sides are perpendicular to the electric field of the transverse electric mode employed.

2.60 Pyramidal Horn (Antenna) — A horn antenna in the shape of a truncated pyramid generally of rectangular cross-section.

2.61 Conical Horn Antenna — A horn antenna in the shape of a truncated cone.

2.62 Horn Reflector Antenna — An antenna consisting of a part of a paraboloidal reflector fed with an offset horn which physically intersects the reflector, part of the wall of the horn being removed to form the antenna aperture.

NOTE — The horn is usually either pyramidal or conical with an axis perpendicular to that of the paraboloid.

2.63 Hoghorn Antenna — A reflector antenna consisting of a reflector in the form of a parabolic cylinder, fed by a sectoral horn which physically intersects the reflector, a part of one of the non-parallel sides of the horn being removed to form the antenna aperture.

2.64 Compound Rectangular Horn Antenna — A horn antenna of rectangular cross-section in which at least one pair of opposing sides has one or more abrupt changes of flare angle or spacing.

2.65 Compound Circular Horn Antenna — A horn antenna of circular cross-section with one or more changes of flare angle or diameter.

2.66 Potter Horn — A compound circular horn with one or more abrupt changes in diameter which excites two or more waveguide modes in order to produce a specified aperture illumination.

2.67 Lens-corrected Horn Antenna — A horn antenna incorporating a radio wave lens in order to produce a specified aperture illumination.

2.68 Multimode Horn — A horn antenna excited by two or more waveguide modes in order to produce a specified aperture illumination.

2.69 Hybrid Mode Horn — A horn antenna excited by one or more hybrid modes in order to produce a specified aperture illumination.

2.70 Corrugated Horn — A hybrid mode horn antenna produced by cutting transverse grooves in the interior walls of the horn.

2.71 Dielectric Rod Antenna — An end-fire antenna which employs a shaped dielectric rod to form the beam.

2.72 Artificial Dielectric — A medium which consists of a regular arrangement of scatterers, usually metallic, embedded in a low permittivity dielectric and which reacts to radio waves in certain frequency range as a continuous dielectric with a permittivity differing from that of the low permittivity dielectric.

Indian Standard
ELECTROTECHNICAL VOCABULARY
PART 21 ANTENNAS
Section 6 Terms Relating to Devices Associated with Antennas
(First Revision)

1. SCOPE

1.1 This standard (Part 21/Sec 6) (First Revision) covers definition of terms relating to devices associated with antennas.

2. TERMINOLOGY

2.1 Feed Line : Feeder

a) A radio frequency transmission line interconnecting an antenna and a transmitter or receiver.

b) For an antenna comprising more than one *driven element*, a radio-frequency transmission line interconnecting the antenna input and a driven element.

2.2 Down-Lead (of an Antenna) — A vertical or inclined *feed line* or segment of a feed line connected at its upper end to an antenna and its lower end to a receiver.

2.3 Balun — A device for transforming an unbalanced voltage to a balanced voltage or *vice-versa*.

NOTE 1 — A balun is used, for example, to couple a balanced antenna to an unbalanced feed line.

NOTE 2 — The term is derived from 'balanced to unbalanced transformer.

NOTE 3 — A balun may be realized in practice by using a transformer or a lumped parameter or distributed parameter network which may include active devices. Classical examples are cited in 2.5 to 2.7.

NOTE 4 — A balun may exhibit inherent impedance transformation differing from unity. Relating terms are : To balance, Balancing.

2.4 Quarter-wave Sleeve Balun — A *balun* composed of a quarter wavelength *coaxial sleeve* surrounding the outer conductor of a coaxial line with one end of the sleeve flush with the end of the line but not connected to it and the other end connected to the outer conductor of the line, thus causing the inner and outer conductors of the line to be balanced at the often end of the sleeve.

2.5 Folded Balun : Pawsey Stub Balun — A *balun* composed of two parallel, generally quarter wavelength conducting tubes, one end of which forms the balanced terminals and the other shortcircuited; the unbalanced coaxial feed line passes through one of the tubes with its outer conductor being connected to that tube and the centre conductor connected to the other tube at the balanced terminals.

NOTE — Often a quarter wavelength sleeve encloses the balun, it being open at the balanced terminals and short-circuited to the tubes at the other and.

2.6 Slotted Coaxial Balun; Split-tube Balun — A *balun* composed of a coaxial line whose outer conductor, at one end, has two diametrically opposite open quarterwave slots; the two sides of the open and forming the electrically balanced terminals with the centre conductor connected to one side.

2.7 Matching Stub — A stub whose length and location is adjusted to match an antenna impedance to that of a transmission line.

2.8 Compensating Network (of an Antenna) — An electrical network connected to the terminals of an antenna and intended to reduce, as far as possible, the variations in complex impedance occurring over a given frequency band.

2.9 Compensation of Impedance Mismatch — Compensation of the impedance mismatch of the element of an antenna, obtained by feeding two driven elements with such phases that the reflected waves on the feed lines to the driven elements substantially cancel each other at feed line junctions or inside power dividers.

2.10 Phase Compensation with more Elements — Compensation of the impedance, mismatch of the elements of an antenna, obtained by feeding driven elements with such phases that the reflected waves on the feed lines to the driven elements substantially cancel each other at feed line junctions or inside power dividers.

2.11 Power Divider; Junction Box — A device with one input and two or more outputs which produces the desired distribution of power from the feed line to the *drive elements* of an antenna.

NOTE — The term 'junction box' is generally used when a simple power divider is enclosed in a weatherproof housing.

2.12 Multiplexer (for an Antenna) — A device which enables several transmitters or several receivers to operate simultaneously, without interaction, using one antenna.

2.13 Diplexer (for an Antenna) — A multiplexer for either two transmitters or groups of transmitters, or two receivers or groups of receivers.

2.14 Branching Filter—A device which enables the use of the same antenna for several transmitters or several receivers operating simultaneously in closely spaced radio frequency channels without interaction.

2.15 Orthomode Transducer — A device which enables a *dual-polarization antenna* to be fed from two *feed lines* which correspond to the two orthogonal polarizations.

2.16 Duplexer (of an Antenna) — A device enabling an antenna to be used for transmitting and receiving simultaneously.

2.17 Antenna Switching Matrix — A system of switches usually in rectangular matrix form, and their associated controls, for connecting each transmitter or receiver at a transmitting or receiving station with any selected antenna.

2.18 Multicoupler (of an Antenna) — A multiplexer generally comprising a broadband amplifier for the connection of several receivers to one antenna without undesired interaction between the receivers or excessive degradation of the signal-to-noise ratio.

NOTE — The term 'multicoupler' is sometimes used to refer to a diplexer for an HF antenna.

2.19 Quarter Wave Choke — A device which interrupts the flow of current along a conductor such as an antenna support and consists of another conductor about a quarterwave in length parallel to the first and connected to it at one end to form a short-circuited transmission line.

NOTE — The quarterwave choke may consist of a sleeve coaxially surrounding the conductor.

2.20 Antenna Tuning Housing — A housing, such as box, cabin, hut, house located near the feed point of an antenna, which encloses devices associated with an antenna such as matching elements, filters or pre-amplifiers.

2.21 SWR Trip — A protective device placed at the output of a radio transmitter so as to interrupt the transmitter's operation when the *standing wave ratio* on the *feed line* exceeds a predetermined value.

2.22 Dummy Load; Dummy Antenna — A non-radiating dissipative network simulating the input impedance of an antenna over a specified frequency range and used as a load for testing a transmitter.

2.23 Radome — A cover usually intended for protecting an antenna from the effects of its physical environment without degrading its electrical performance.

INDEX

NOTE — This index has been prepared in accordance with IS : 1275-1976*. Index numbers are clause numbers.

A

(Absolute) gain (of an antenna) (in a given direction), 2.4.1, Sec 2
Active antenna 2.29, Sec 3
Adaptive antenna system, 2.31, Sec 3
Adcock (array) antenna, 2.56, Sec 4
Aerial, 2.1, Sec 1
Alford loop (antenna), 2.38, Sec 4
Annular slot antenna, 2.37, Sec 5
Antenna, 2.1, Sec 1
  Active Adcock (array) array, 2.5, Sec 1
  bay, 2.15, Sec 1
  current. 2.65, Sec 2
  efficiency (for an aperture type antenna), 2.53, Sec 2
  (input) admittance, 2.72, Sec 2
  (input) impedance, 2.71 Sec 2
  switching matrix, 2.17, Sec 6
  system, 2.2, Sec 1
  adaptive tuning housing, 2.20, Sec 6
  wavelength, 2.67, Sec 2
Anti-jamming array, 2.23, Sec 3
Aperture
  blockage, 2.56, Sec 2
  blocking factor (in a reflector antenna), 2.57, Sec 2
  illumination efficiency, 2.52, Sec 2
  illumination (function), 2.49, Sec 2
  (of an antenna), 2.48, Sec 2
Array
  (antenna), 2.5, Sec 1
  factor, 2.15, Sec 2
Artificial dielectric, 2.72, Sec 5

B

Back fire antenna, 2.10, Sec 3
  lobe, 2.26, Sec 2
  scattering area (of an antenna), 2.47, Sec 2
  scattering cross-section (of an antenna), 2.47, Sec 2
Balanced (antenna, 2.36, Sec 3
Balun, 2.3, Sec 6
Bandwidth (of an antenna), 2.78, Sec 2
Baresight (of an antenna), 2.36, Sec 2
Bat-wing
  antenna, 2.38, Sec 5
  panel, 2.41, Sec 5
Bazooka (USA), 2.4, Sec 6
Beam axis (of an antenna), 2.32, Sec 2
Beamwidth, 2.33, Sec 2
Beaver-tail beam antenna, 2.15, Sec 3
Beelini-Tosi antenna, 2.57, Sec 4
Beverage antenna, 2.58, Sec 4
Biconical antenna, 2.40, Sec 4
Boresight error (of an antenna), 2.36, Sec 2
Branching filter, 2.14, Sec 6
Broadband antenna, 2.27, Sec 3
Broadside array, 2.8, Sec 3

C

CMF (abbreviation), 2.9, Sec 2
Cage antenna, 2.10, Sec 4
Capacity top, 2.23, Sec 4
Cassegrain reflector antenna, 2.18, Sec 5
Chebyshev array, 2.69, Sec 4
Cheese antenna, 2.22, Sec 5
Chireix-Mesny antenna, 2.61, Sec 4
Cigar antenna, 2.43, Sec 5
Circular array, 2.10, Sec 1
Clover-leaf antenna, 2.48, Sec 4
Coaxial antenna, 2 42, Sec 4
Cold-point (of a radiating element), 2.70, Sec 2
Compensating network (of an antenna), 2.8, Sec 6
Compound rectangular horn, 2.64, Sec 5
Conformal
  antenna, 2.13, Sec 1
  array, 2.14, Sec 1
Conical
  array, 2.8, Sec 1
  horn antenna, 2.61, Sec 5
Constrained lens, 2.51, Sec 5
Contoured-beam antenna, 2.13, Sec 3
Co-polar pattern (of an antenna), 2.20, Sec 2
Corner reflector antenna, 2.44, Sec 5
Corrugated horn, 2.70, Sec 5
Cosecant-square beam antenna, 2.17, Sec 3
Counterpoise, 2.31, Sec 4
Cross-polar pattern (of an antenna), 2.21, Sec 2
Cross-polarization discrimination ratio (of an antenna), 2.21, Sec 2
Curtain antenna, 2.59, Sec 4
Cutler feed, 2.30, Sec 5
Cylindrical
  array, 2.9, Sec 1
  reflector, 2.9, Sec 5
Cymomotive force (in a given direction), 2.9, Sec 2

D

Dielectric
  lens, 2.45, Sec 5
  rod antenna, 2.71, Sec 5
Dihedral corner reflector, 2.13, Sec 5
Diplexer (for an antenna), 2.13, Sec 6
Dipole,
  (antenna), 2.14, Sec 4
  curtain antenna, 2.60, Sec 4
Directional
  antenna, 2.2, Sec 3
  null, 2.31, Sec 2
  null antenna, 2.3, Sec 3
Directivity (of an antenna) (in a given direction), 2.40, Sec 2
Director element (of an antenna), 2.6, Sec 4
Discone, 2.41, Sec 4
Discrimination ratio (of an antenna between two received antenna), 2.80, Sec 2
Dolph-Chobyshev array, 2.69, Sec 4
Doublet (antenna), 2.14, Sec 4
Down-lead (of an antenna), 2.2, Sec 6
Driven element, 2.3, Sec 4
Dual-polarized antenna, 2.6, Sec 3
Dummy
  antenna, 2.22, Sec 6
  load, 2.22, Sec 6
Duplexer (of an antenna), 2.16, Sec 6

E

EIRP (abbreviation), 2.59, Sec 2
EMRP (abbreviation), 2.61, Sec 2
ERP (abbreviation), 2.60, Sec 2
Earth
  mat, 2.32, Sec 4
  system, 2.30, Sec 4
Effective
  height (of an antenna), 2.76, Sec 2
  length (of an antenna), 2.76, Sec 2
  monopole radiated power (in a given direction), 2.61, Sec 2
  radiated power (in a given direction), 2.60, Sec 2
Eggerate lens, 2.52, Sec 5
Electrical
  boresight (of an antenna), 2.34, Sec 2
  length (of a radiating element), 2.68, Sec 2

---

*Rules for making alphabetical indexes.

(Elementary)
  electric dipole, 2.1, Sec 4
  magnetic dipole, 2.2, Sec 4
E-plane
  lens, 2.49, Sec 5
  sectoral horn (antenna), 2.58, Sec 5
Equiangular spiral antenna, 2.67, Sec 4
Equivalent radius
  (of a conductor), 2.8, Sec 4
  (of a multi-wire element), 2.9, Sec 4
Equivalent isotropically radiated power (in a given direction), 2.59, Sec 2
End
  capacitor, 2.23, Sec 4
  fire array, 2.9, Sec 3

F

Fan-beam antenna, 2.14, Sec 3
Far field region, 2.2, Sec 2
Fed element, 2.3, Sec 4
Feed
  efficiency, 2.55, Sec 2
  line, 2.1, Sec 6
  (of an array), 2.17, Sec 1
  (of reflector or lens antennas), 2.26, Sec 5
Feeder, 2.1, Sec 6
Ferrite rod antenna, 2.36, Sec 4
Field strength-distance product, 2.9, Sec 2
Figure of merit
  (of an antenna), 2.63, Sec 2
  (of an antenna-receiving system), 2.64, Sec 2
Fishbone antenna, 2.50, Sec 4
Flat-top antenna, 2.44, Sec 4
Flush-mounted antenna, 2.12, Sec 1
Flush mounted antenna, 2.13, Sec 1
Focusing reflector, 2.3, Sec 5
Folded
  balun, 2.5, Sec 6
  dipole (antenna), 2.18, Sec 4
  monomople (antenna), 2.27, Sec 4
  unipole (antenna), 2.27, Sec 4
Franklin antenna, 2.62, Sec 4
Fraunhofer region, 2.3, Sec 2
Frequency independent antenna, 2.28, Sec 3
Fresnel
  lens antenna, 2.47, Sec 5
  region, 2.5, Sec 2
Full-wave dipole, 2.17, Sec 4

G

G/T (abbreviation), 2.64, Sec 2
Gabled distribution (of a field over an antenna), 2.51, Sec 2
Gregorian reflector antenna, 2.19, Sec 5
Ground
  mat, 2.32, Sec 4
  plane antenna, 2.29, Sec 4
  system (of an antenna), 2.30, Sec 4

H

  antenna, 2.51, Sec 4
  plane lens, 2.50, Sec 5
  plane sectoral horn (antenna), 2.59, Sec 5
Half
  dipole, 2.15, Sec 4
  doublet, 2.15, Sec 4
  wave dipole, 2.16, Sec 4
Helix antenna, 2.65, Sec 4
Hertzian
  (electric) dipole, 2.1, Sec 4
  magnetic dipole, 2.2, Sec 4
Hoghorn antenna, 2.63, Sec 5
Horn
  (antenna), 2.55, Sec 5
  reflector antenna, 2.62, Sec 5
Hybrid mode horn, 2.69, Sec 5

I

Illumination
  diagram, 2.50, Sec 2
  pattern, 2.50, Sec 2
Image antenna, 2.77, Sec 2
Inclined V antenna, 2.54, Sec 4
Induction field (region), 2.1, Sec 2
Infinite simal dipole, 2.1, Sec 4
Intermediate feed antenna, 2.46, Sec 4
Inverted
  L antenna, 2.52, Sec 4
  V antenna, 2.55, Sec 4
Isolation ratio (of a multiport antenna), 2.79, Sec 2
Isotropic
  gain (of an antenna) (in a given direction), 2.41, Sec 2
  radiator, 2.1, Sec 3

J

Junction box, 2.11, Sec 6

L

Lattice reflector, 2.7, Sec 5
Leaky-wave antenna, 2.34, Sec 3
Lens-corrected horn antenna, 2.67, Sec 5
Linear array (antenna), 2.6, Sec 1
Loaded folded dipole, 2.20, Sec 4
Log periodic antenna, 2.66, Sec 4
Long-wire antenna, 2.43, Sec 4
Loop antenna, 2.33, Sec 4
Low
  noise antenna, 32.2, Sec 3
  temperature antenna, 2.32, Sec 3
Lunesburg lens antenna, 2.54, Sec 5

M

Magnetic core antenna, 2.35, Sec 4
(Main) beam (of an antenna), 2.30, Sec 2
Main
  lobe, 2.24, Sec 2
  reflector, 2.5, Sec 5
Major lobe, 2.24, Sec 2
Matching stub, 2.7, Sec 6
Microstrip antenna, 2.70, Sec 4
Minor lobe, 2.25, Sec 2
Monopole (antenna), 2.26, Sec 4
Multi
  beam antenna, 2.18, Sec 3
  cellular lens, 2.52, Sec 5
  conductor element, 2.7, Sec 4
  coupler (of an antenna), 2.18, Sec 6
  mode antenna, 2.22, Sec 3
  mode horn, 2.68, Sec 5
  pattern antenna, 2.18, Sec 3
  wire element, 2.7, Sec 4
(Multiple) band antenna, 2.35, Sec 1
Multiple
  folded dipole, 2.19, Sec 4
  unit steerable array, 2.68, Sec 4
Multiplexer (for an antenna), 2.12, Sec 6
Musa antenna, 2.68, Sec 4
Mutual impedance (for antenna element), 2.73, Sec 2

N

Noise temperate (of a receiving antenna), 2.62, Sec 2
Non-driven element, 2.4, Sec 4
Null-steering antenna, 2.4, Sec 3

O

Offset
  feed, 2.28, Sec 5
  paraboloidal reflector antenna, 2.17, Sec 5
Omni-directional antenna (in a given plane), 2.7, Sec 3
Orthomode transducer, 2.15, Sec 6

P

Panel
  radiating dipoles, 2.63, Sec 4
  (of radiating element), 2.6, Sec 1
Parabolic,
  cylinder antenna, 2.20, Sec 5
  torus reflector, 2.12, Sec 5
Paraboloidal
  reflector, 2.8, Sec 5
  reflector antenna, 2.16, Sec 5
Parallel plate lens, 2.48, Sec 5
Parasitic element, 2.4, Sec 4
Partial
  effective area (of antenna for a given polarization and direction), 2.44, Sec 2
  gain (of an antenna for a given polarization), 2.42, Sec 2
Passive reflector, 2.2, Sec 5
Pawsey stub balun, 2.5, Sec 6
Pencil-beam antenna, 2.16, Sec 3
Perforated lens, 2.53, Sec 5
Periscope antenna, 2.21, Sec 5
Phase
  centre, 2.19, Sec 2
  diagram, 2.18, Sec 2
  pattern, 2.16, Sec 2
  pattern (graphical representation), 2.17, Sec 2
  pattern (mathematical representation), 2.17, Sec 2
Phased array antenna, 2.20, Sec 3
Pill-box antenna, 2.23, Sec 5
Planar array (antenna), 2.7, Sec 1
Polarization
  decoupling ratio (of an antenna), 2.22, Sec 2
  match 2.8, Sec 2
  of an antenna (in a given direction), 2.7, Sec 2
Potter horn, 2.66, Sec 5
Power divider, 2.11, Sec 6
Primary radiator, 2.27, Sec 5
Pyramidal horn (antenna), 2.60, Sec 5

Q

Quadrant antenna, 2.37, Sec 4
Quarter wave
  choke, 2.19, Sec 6
  sleeve balun, 2.4, Sec 6
  sleeve element, 2.11, Sec 6

R

Radome, 2.23, Sec 6
Radiant intensity (from a source in a given direction), 2.39, Sec 2
Radiation diagram, 2.14, Sec 2
  efficiency (of an antenna), 2.58, Sec 2
  intensity, 2.39, Sec 2
  lobe 2.23, Sec 2
  pattern, 2.11, Sec 2
  pattern (graphical representation), 2.14, Sec 2
  pattern (mathematical representation), 2.12, Sec 2
  pattern (surface), 2.13, Sec 2
  resistance (of an antenna), 2.75, Sec 2
Radiating
  aperture (of an antenna), 2.48, Sec 2
  element, 2.4, Sec 1
  near field (region), 2.4, Sec 2
(Radio wave) lens, 2.31, Sec 5
Rayleigh region, 2.1, Sec 2
Reactive
  near field (region), 2.1, Sec 2
  reflector antenna, 2.25, Sec 5
Reference boresight (of an antenna), 2.34, Sec 2
Reflecting surface, 2.1, Sec 5
Reflective array antenna, 2.25, Sec 5
Reflector, 2.1, Sec 5
  antenna, 2.4, Sec 5
  (element) (of an antenna), 2.5, Sec 4
Relative
  gain (of an antenna with respect to that of a reference antenna), 2.43, Sec 2
  side lobe level (for a specified polarization), 2.28, Sec 2
Radiation, 2.6, Sec 2
Reversible antenna, 2.34, Sec 3
Rhombic horn (antenna), 2.39, Sec 4
Ridged horn (antenna), 2.56, Sec 5
Ring array, 2.11, Sec 1
Rotating-field antenna, 2.11, Sec 3

S

SCMF (abbreviation), 2.10, Sec 2
SWR (abbreviation), 2.21, Sec 6
Secondary
  lobe, 2.25, Sec 2
  radiation, 2.6, Sec 2
Sectoral horn (antenna), 2.57, Sec 5
Self-impedance (of an antenna elements), 2.74, Sec 2
Series-loaded antenna, 2.25, Sec 4
Scanning antenna, 2.21, Sec 3
Scattering
  area (of an antenna), 2.46, Sec 2
  cross-section (of an antenna), 2.46, Sec 2
Shaped-beam antenna, 2.12, Sec 3
Shielded-loop antenna, 2.34, Sec 4
Side
  lobe, 2.27, Sec 2
  lobe suppression, 2.29, Sec 2
Signal
  processing antenna, 2.30, Sec 3
  polarized antenna, 2.5, Sec 3
Sinusoidal distribution (of a current in an antenna), 2.66, Sec 2
Slot
  antenna, 2.33, Sec 5
  array (antenna), 2.34, Sec 5
  radiator, 2.32, Sec 5
Slowing (array) antenna, 2.26, Sec 3
Sleeve
  dipole (antenna), 2.21, Sec 4
  monopole (antenna), 2.22, Sec 4
  stub (antenna), 2.22, Sec 4
Slotted
  coaxial balun, 2.6, Sec 6
  cylinder (antenna), 2.35, Sec 5
  cylinder panel, 2.42, Sec 5
  panel, 2.40, Sec 5
  waveguide (antenna), 2.36, Sec 5
Specific
  cymomotive force (in a given direction), 2.10, Sec 2
  field strength-distance product, 2.10, Sec 2
Spherical
  array, 2.10, Sec 1
  reflector, 2.10, Sec 5
  reflector antenna, 2.15, Sec 5
Spill
  over factor 2.55, Sec 2
  over power, 2.54, Sec 2
Spilt
  antenna, 2.25, Sec 3
  tube balun, 2.6, Sec 6
Squint, 2.37, Sec 2
  angle, 2.38, Sec 2
Standing wave antenna, 2.71, Sec 4
Steerable-beam antenna, 2.19, Sec 3
Sub-reflector, 2.6, Sec 5
Super-turnstile antenna, 2.39, Sec 5
Superdirectivity, 2.81, Sec 2
Surface-wave antenna, 2.33, Sec 3
SWR trip, 2.21, Sec 6
Symmetrical
  antenna, 2.12, Sec 4
  radiating element, 2.13, Sec 4

T

T-antenna, 2.53, Sec 4
Tapered distribution (of a field over an aperture), 2.51, Sec 2
Top-loaded antenna, 2.24, Sec 4
Toroidal reflector, 2.11, Sec 5
(Total) effective area (of an antenna for a given direction) 2.45, Sec 2

Travelling wave antenna, 2.72, Sec 4
Trihedral corner reflector, 2.14, Sec 5
Turnstile antenna, 2.49, Sec 4

U

Umbrella
  antenna, 2.45, Sec 4
  reflector antenna, 2.24, Sec 5
  unipole (antenna), 2.26, Sec 4

V

Vertex plate (of paraboloidal reflector), 2.29, Sec 5
Vertical
  monopole (antenna), 2.28. Sec 4
  unipole (antenna), 2.28, Sec 4

W

Wavelength reduction factor, 2.69, Sec 2
Wide-band antenna, 2.27, Sec 3
Whip antenna, 2.47, Sec 4

Y

Yagi antenna, 2.64, Sec 4
Yagi-Uda antenna, 2.64, Sec 4

Z

Zone
  lens-stepped lens, 2.46, Sec 5
  plate lens antenna, 2.47, Sec 5

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†Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 — 896528

Printed at New India Printing Press, Khurja, India